PRECAST CONCRETE: ENVIRONMENTAL FRIENDLY CONSTRUCTION

Prestressed Precast Concrete technology involves manufacturing concrete elements such as Hollow Core Slabs, Beams, Columns, Stair cases, etc., in a quality controlled environment by using less resources and in an environmental friendly manner. These manufactured elements are transported to construction sites where the buildings are erected.

Hollow Core Slabs:
Every Prestressed Precast concrete element is an environmental friendly green category product. In particular, Hollow Core Slabs (HCS) have several additional features contributing to the environmental protection / natural resources conservation including the following:

(i) HCS have up to 50% less self-weight against cast-in-situ concrete slabs. Due to this dead weight of the structure will be far less and thereby requiring fall less construction materials for the lighter structural frames.
(ii) HCS create long spans avoiding many intermediate columns. Due to this more usable space gets created in the structure leaving relatively more land for greenery and other purposes.
(iii) The voids in HCS are usable to run electrical, air conditioning, and other service pipes.
(iv) HCS have far less sound transmissions and vibrations. Further, being produced with lower water-cement ratios and having sturdiness, HCS have higher Indoor Air Quality.
(v) HCS bottom surface (soffit) has near lamination smoothness and therefore, consumes less paint thereby reducing the usage of chemicals.

Energy Conservation Building Code:
Government of India has been implementing Energy Conservation Building Code (ECBC) to ensure conservation of natural resources. Consequently, in August 2013, Government of Andhra Pradesh made ECBC issued by Board of Energy Efficiency, GoI mandatory. Hollow Core Slabs, one of the main products of our unit are the major concrete elements to comply with the code. The news extracts are enclosed as **Annexure – A**.

Environment Clearance: Precast Technology:
Ministry of Environment & Forests, GoI, recognized the eco benefits in Precast System and suggested the usage of precast / Hollow Core Slabs in its 'Manual on norms and standards for environment clearance of large construction projects' Extracts are enclosed as **Annexure – B**.

Green Buildings: Precast Construction:
Precast Prestressed Concrete technology is the major facilitator of Green Buildings. Precast elements are of green category and eco-friendly. Precast construction automatically contributes up to 26 LEED points for Green Building Certification. Our unit has the natural ability to contribute up to 23 LEED points. The list of credit points is enclosed as **Annexure – C**.

Environmental Advantages: With Precast Construction:
Precast Construction has multiple environmental advantages. Few of them are briefly listed and enclosed as **Annexure – D.**

Green Manufacturing Award: Precast Construction:
For our Good Manufacturing Practices and Green Category products, Green Manufacturing Award was given to PRECA in 2013 by World CSR Day & Stars of the Industry, USA Group.

ANNEXURE: A

ENERGY CONSERVATION BUILDING CODE

Business Standard

BS Reporter | Chennai/ Hyderabad
June 16, 2013 Last Updated at 21:29 IST

AP set to notify GO on energy conservation building code:

As part of its six-point programme on EE and EC (energy efficiency and energy conservation), the Andhra Pradesh government is planning to notify the energy conservation building code (ECB code) for enhancing energy efficiency in all large buildings such as multiplexes, malls and hospitals, according to chief secretary and chairman of the State Energy Conservation Mission SECM) PK Mohanty.

"An ECB Code is in the offing for incorporating energy efficiency components. The code will be applicable to all non-residential buildings with more than 1,000 square metre of plot area or 2,000 square metre of built-up area, whichever is higher. Initially, a single-star energy conservation shall be made mandatory in respect of all these structures. Certification of energy conservation for these buildings will be issued by the Bureau of Energy Efficiency (BEE)-empanelled architects," he said here on Sunday.

The state government will be finalising a 'Green Factory Building Code' for promoting energy efficiency in existing and upcoming industries, besides evolving measures for replacement of old and inefficient motors and pumpsets in urban and rural water supply schemes.

"The state industries department is working out the modalities to bring in the Green Factory Building Code for all factories for taking mandatory steps to provide vegetation in at least 15 per cent of the total site area, allowing natural daylight and fresh air ventilation into the factory building," Mohanty said.

The state government is also considering promoting and scaling up generation through non-renewable sources like solar and wind, and studying the best practices on energy efficiency to benchmark with international standards in power-intensive sectors, he added.

ANNEXURE – B

ENVIRONMENTAL CLEARANCE: PRECAST TECHNOLOGY

Manual on norms and standards for environment clearance of large construction projects

Ministry of Environment and Forests,
Government of India

4.3.1.2 Roofing

The conventional material used for roofing is RCC, as it is suitable for longer spans. The constituents of RCC, i.e, cement, sand, aggregate and steel all are energy intensive materials and high-embodied energy content. This section of the chapter gives alternatives is given as a substitute of the conventional materials.

Alternate Materials for roofing

1. Use of lightweight synthetic aggregate- The example is Fly ash based aggregate, which is suitable for manufacture of brick, blocks, and is good substitute for clinker and natural aggregates.
2. Pre-cast/aerated cellular concrete walling blocks and roofing slabs- These are manufactured by the aerated cellular concrete manufacturing process. When used in multi- storied structures, they reduce the weight, resulting in a more economical design. They have high rating to fire resistance and provide better insulation.

Alternate techniques for roofing

Construction in concrete put high cost on environment and as it has become a very common practice to use RCC for construction of frames, some alternatives must be used to minimize its use. These are :

1. Zipbloc system- This system developed in India, utilizes a single precast element, a hourdi-type hollow block 530 × 250 × 140 mm for walls and roofs.

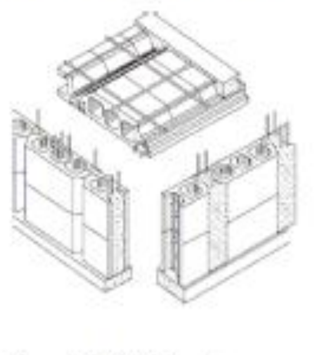

Figure 4.10. Zip block system

2. *Pre-stressed slab elements*- This roofing system was developed at the Structural Engineering Research Centre in Chennai. The hollow blocks used are 'Hourdi' or similar blocks, and may be placed in one or more rows. Concrete ribs of at least a four-centimetre width

ensuring good cover from all sides. The joists is manually laid in parallel lines as shown in Figure 4.11c, at distances of 300 mm c/c. The structural clay units, with their wider base below, are laid between the joists as filler units, ensuring that the joints in the joist member and filler units are broken (using half length units at the ends). The joints and gaps are filled with mortar, reinforcement, and concrete. The completed slab is kept wet for 14 days before finishing the floor or roof surface.

4. Hollow floor slabs – This is one more option for material reduction. The overall dimensions of the unit are 3500 × 600 × 120 mm. In this method the steel end-pieces with four openings define a trapezium-shaped cross section of the floor slab, so that when finally assembled, the V-shaped gaps between the slabs can be easily filled with concrete. Reinforcement is laid and four GI pipes are pushed lengthwise (Figure 4.12) through the holes in the end. The concrete is poured and compacted simultaneously to ensure that no air pockets are developed around the pipes. The concrete is cast very dry so that it does not collapse when the pipes are removed. The pipes are later pulled out with an electrical winch as shown in Figure.

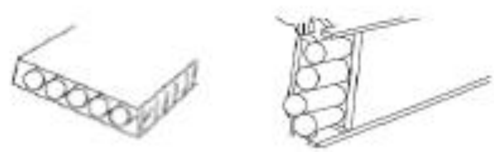

Figure 4.12. Hollow Floor slabs

5. Precast ferro-cement folded plate-roofing element- Folded plates with a trapezoidal cross-section either in the form of a 'hat' or in the form of a trough section give high rigidity and ensure safety. Such a trough section can be conveniently made of ferro-cement. Roofs made of such trough sections can be constructed by simply assembling such precast FCFP (ferro-cement folded plate) elements side by side on supports (sectional details are given in Figure 4.13), which may be of wall or beam with no in-filling. When required it can be shifted and re-erected as desired. The span length of FCFP element up to 12 feet 6 inches (3810 mm) is adopted for the sake of convenience in handling/hoisting and placing without any mechanical aid. Design of a precast FCFP element (with no diaphragm) may be done as an

ANNEXURE – C

GREEN BUILDINGS: PRECAST CONSTRUCTION

Scoring of LEED Green Building Certification Points with Precast Prestressed Concrete

The following table depicts the credit references and the credit earning factors under LEED category by using precast concrete construction.

LEED Category	Credit Reference	Credit Earning Factor	Points
Innovation & Design	Credit 1.1 to 1.4	Innovation in design	2
	Credit 1.1 to 1.4	Use of Supplementary Cementitious Materials (SCM)	1
	Credit 1.2	LEED Accredited Professional	1
Sustainable Sites	Credit 5.1	Site Development: Protect or Restore Habitat	1
	Credit 7.1	Heat Island Effect: Non - Roof	1
Materials & Resources	Credit 2.1	Construction Waste Management: Divert 50% from disposal	1
	Credit 2.2	Construction Waste Management: Divert 75% from disposal	1
	Credit 4.1	Recycled content, use 5% post - consumer or 10% other	1
	Credit 4.2	Recycled content, use 5% post - consumer or 20% other	1
	Credit 5.1	Regional Materials: 10% Extracted, Processed & Manufactured Regionally	1
	Credit 5.2	Regional Materials: 20% Extracted, Processed, & Manufactured Regionally	1
Indoor Environmental Quality	Credit 3.1	During Construction: Indoor Air Quality Management Plan	1
Energy & Atmosphere	Credit 6.1	Optimize Energy Performance	10
Total LEED points with precast prestressed concrete construction			23

LEED Points with Precast Construction: Although it has been widely pronounced that Precast Construction can earn 26 LEED Points, considering Indian climatic conditions, on a conservative note, only 23 points have been considered.

Credit Clauses Reference Document: Leadership in Energy and Environmental Design (LEED) 2011 for India, ver: February 2011 by Indian Green Building Council (IGBC).

ANNEXURE – D

ENVIRONMENTAL ADVANTAGES OF PRESTRESSED PRECAST CONSTRUCTION

1. Since Precast Prestressed Concrete Technology enables rapid yet safe construction (actually erection), the impact on the local community of the project sites and the traffic around the project site will be very minimal.

2. With major activity viz., manufacturing of all the precast concrete elements being made at Factory, the work conditions are much safer, and healthy for workforce.

3. Materials are stored within a confined area and particularly in safer conditions in Factory thereby reducing the risks of pollution which is usually caused due to the scattered materials at the project sites.

4. No packing is required for the precast concrete elements and therefore there is no supplementary wastage on account of precast construction.

5. With large size precast elements, the usage time of crane, tripods, and lifts etc., are minimized thereby saving considerable amount of energy.

6. Since manufacturing takes place at Factory, considerably minimizes the usage of water at the project sites where water remains one of the scarce resources.

7. Since the water used in the Factory is recycled for other uses within Factory, even at Factory the water resources are not unduly wasted.

8. Usage of wood in Precast Construction is very minimal as steel moulds are predominantly used. Further, since steel moulds have much longer life, say between 10 to 25 years, the natural resources are preserved.

9. With minimum activity at construction site, the air pollution is very minimal.

10. All the precast elements are recyclable at the end-of-life stage of the construction.